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# *Information Bulletin*

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*Grade 9 Science*  
*1994-96*

This document was written primarily for:

Students	✓
Teachers	✓
Administrators	✓
Parents	
General Audience	
Others (Specify)	✓ Superintendents

This bulletin contains general information about the Achievement Testing Program and information specific to the Grade 9 Science Assessment. Additional copies of the bulletin may be made as needed.

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**October 1994**



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## ***General Information***

The Achievement Testing Program provides teachers, parents, students, school administrators, Alberta Education, and the public with information about what students know and can do in relation to provincial standards. Group results are reported at school, district, and provincial levels to improve learning opportunities for students.

The assessments are administered in two subject areas at Grade 3—language arts and mathematics—and in four subject areas at grades 6 and 9—language arts, mathematics, social studies, and science.

The assessments are based on provincial standards, which reflect important learnings in the subject areas listed above. Classroom teachers from across the province are extensively involved in developing and field testing the assessment instruments.

### ***Administering the Assessment***

Information about the nature of the provincial assessments as well as their administration to special-needs students can be found in the *General Information Bulletin, Achievement Testing Program*, which has been mailed to all superintendents and principals.

### ***Schedule***

The written-response component of English and French Language Arts must be administered during the first week of June. The machine-scorable component of all achievement tests must be administered during the last two weeks of June. Specific information regarding scheduling is provided in the current *General Information Bulletin*.

To minimize any risks to security, we recommend that all students complete the test on the same day. Students who are absent when the tests are administered and who return to school by the end of the school year must write the tests upon their return. By scheduling the tests early in the administration period, schools can ensure that most, if not all, absentees are tested. The principal is responsible for ensuring the security of the tests.

Beginning in 1995, the tests that will be administered each year are:

#### **Grade 3**

English Language Arts (*Part A: Writing and Part B: Reading*)  
Mathematics (English and French forms)

#### **Grade 6**

English Language Arts (*Part A: Writing and Part B: Reading*)  
Mathematics (English and French forms)  
Social Studies (English and French forms)  
Science (English and French forms)  
Français 6<sup>e</sup> Année (*Partie A: Production écrite and Partie B: Lecture*)

#### **Grade 9**

English Language Arts (*Part A: Writing and Part B: Reading*)  
Mathematics (English and French forms)  
Social Studies (English and French forms)  
Science (English and French forms)  
Français 9<sup>e</sup> Année (*Partie A: Production écrite and Partie B: Lecture*)

### ***Students in French Language Programs***

Beginning in June 1995, all students in Francophone and French Immersion programs must write the French form of the achievement tests. Alberta Education will send enrollment forms to schools by February requesting an indication of how many English or French tests are required. These forms must be returned through jurisdiction offices by mid-March.



### ***Marking Achievement Tests Locally***

Beginning in June 1995, teachers will be able to mark the tests before returning them to Alberta Education. Teachers can use the results as part of an individual student's year-end assessment, as well as for planning instruction. Additional information regarding local marking of tests will be provided in December 1994.

### ***Reporting the Results***

Each school jurisdiction will receive a district report and school reports for their students' achievement, as well as guidelines for interpreting these results in relation to provincial standards.

To facilitate reflection on school programs, we expect that results will be shared with all school staffs (not just teachers of grades 3, 6, and 9), as well as with parents and the community.

Individual student profiles will be sent to the school that the student will attend in September. We also expect that these reports will be shared with parents.

Provincial results will be made public in September. A detailed *Achievement Testing Program Provincial Report* is published annually.

### ***Broadened Assessment Initiatives***

The Student Evaluation Branch has developed additional instruments to collect a broader base of information about what students know and can do than achievement tests themselves can provide. These instruments will be administered to a provincial sample of students in all subjects on a rotating basis:

#### **Grade 3**

- 1995 •“whole book” performance-based assessment in language arts
- 1996 •problem-solving activities in mathematics
- 1997 •“whole book” performance-based assessment in language arts
- 1998 •problem-solving activities in mathematics

#### **Grade 6**

- 1995 •problem-solving activities in mathematics
- 1996 •“whole book” performance-based assessment in language arts
- 1997 •problem-solving and decision-making activities in social studies
- 1998 •performance tasks in science

#### **Grade 9**

- 1995 •problem-solving and decision-making activities in social studies
- 1996 •problem-solving activities in mathematics
- 1997 •performance tasks in science
- 1998 •performance tasks in language arts

## ***Description of the Science Assessment Standards***

The provincial standards are the basis upon which we assess how well students have learned science by the end of Grade 9. These standards reflect the essential learnings that all Alberta students are expected to achieve. Provincial Standards are useful, therefore, for assessing Grade 9 students in all types of school programs—public, private, and home education.

### ***Purpose of Assessment Standards***

These statements describe what is expected of Grade 9 students who are meeting the *acceptable standard* or the *standard of excellence* on independent work at the end of the Grade 9 Science program. The statements represent the standards against



which student achievement will be measured. By comparing actual results to provincial standards, decisions can be made about whether achievement is in fact “good enough.”

### ***Acceptable Standard***

Students meeting the *acceptable standard* of performance in Grade 9 Science are expected to have a basic understanding of the conceptual and procedural knowledge that is essential to the Junior High science program. For example, they can easily apply concepts and basic procedures in simple and familiar situations in which they have had previous experience, but they are challenged when applying these concepts and procedures to unfamiliar or complex situations. Students may be able to identify the name of an organism in a classification system, for example, but have difficulty interpreting the relationship of organisms at the same classification level.

For performance to be considered *acceptable*, students are expected to know how to apply higher level thinking skills in familiar situations. However, students may have difficulty applying these skills in new or unfamiliar situations. For example, they can predict the effects of linking a familiar and identical electrical load in series or parallel circuit, but may have difficulty predicting the effects of linking different or unfamiliar types of electrical loads in these circuits. They can use basic skills to show what they know and can do in novel real-life problems that are simple or that require single-step solutions. Also, they can apply more advanced skills or follow multi-step procedures to solve familiar real-life problems in which they have had prior experience. For example, in a problem-solving activity to find the best insulating material, these students will be able to develop a simple and controlled procedure, collect a set of data, and determine the best insulator. However, their procedures will likely not have more than one manipulated

variable and may lack a complete and logical explanation of results.

Students who meet the *acceptable* level of performance generally have a positive attitude toward learning about the world in which they live. They appreciate how science and technology affect them on a day-to-day basis. They are skilled in using the basic procedures of science inquiry, technological problem solving, and societal decision making; however, they have difficulties with the application of more advanced skills and have limited ability to make connections between science, technology, and society.

### ***Standard of Excellence***

Most students who meet the *standard of excellence* in Grade 9 Science have a superior understanding of the essential conceptual and procedural knowledge outlined in the *Program of Studies*. They can quickly and confidently apply this knowledge in complex and novel situations. For example, not only can they identify the abiotic factors that affect the health and distribution of living things, they also can predict the possible outcomes of changing abiotic factors on living things and evaluate their effects on the quality of the environment.

These students are expected to be able to apply higher level thinking skills to unfamiliar situations. In addition, they can easily and quickly solve problems they have direct experience with and that require single-step or multi-step solutions. These students can solve a problem in more than one way and can see more than one solution for some problems. For example, not only are they familiar with the basic operation of an electric motor, but they can troubleshoot an inoperative motor, make design changes to meet varying performance criteria, and construct a working motor.



Students meeting the *standard of excellence* have a positive attitude about science and its role in their world. They are curious, open-minded, creative, and confident. In addition, they are persistent problem solvers and have the ability to view a situation from a number of perspectives. Not only do they have a high level of awareness and understanding of how science and technology affect them personally, they can translate this understanding and awareness to societal issues. They are skilled in using the basic procedures of science inquiry, technological problem solving, and societal decision making. They can successfully use advanced skills and make connections between science, technology, and society.

## Grade 9 Science Assessment

### General Description

The Grade 9 Science assessment instrument (machine scored) consists of two parts:

Part A has 60 multiple-choice questions each with a value of one mark.

Part B has 5 numerical-response questions each with a value of one mark.

Students are to record their answers on a separate answer sheet.

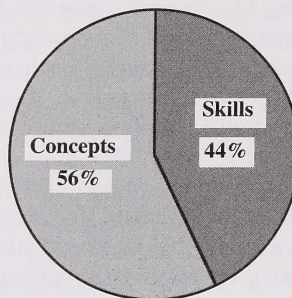
The assessment is designed to be completed in 90 minutes. However, additional time of approximately 30 minutes may be provided to allow students to finish. We suggest that those students who finish writing before one hour has elapsed remain at their desks to review their answers.

Students will need HB pencils, erasers, and scrap paper.

### Content

This assessment is based on six science units within which nature of science; science and technology; and science, technology and society are integrated components.

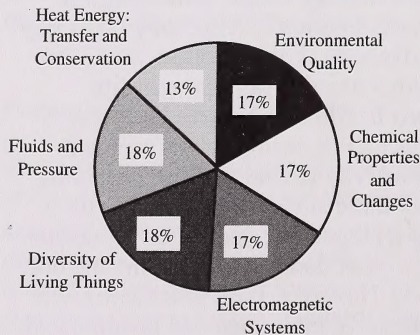
The learning domains, concepts and skills, are integrated in the assessment. The skills domain consists of inquiry skills, technological problem-solving skills, and societal decision-making skills. The weighting for each domain is shown in the following circle graph:



The subject matter component is divided into six assessment components:

- 9.1 Diversity of Living Things
- 9.2 Fluids and Pressure
- 9.3 Heat Energy: Transfer and Conservation
- 9.4 Electromagnetic Systems
- 9.5 Chemical Properties and Changes
- 9.6 Environmental Quality

The weighting given to each assessment component is shown in the following circle graph:





## Blueprint

The emphasis for each topic and learning domain are presented in the blueprint.

### Blueprint Grade 9 Science Assessment

Topic	Percent of Course and Number of Questions	Percent Emphasis and Number of Questions*	
		Learning Domain	
		Concepts	Skills
1. Diversity of Living Things	18 (13)	12 (9)	6 (4)
2. Fluids and Pressure	18 (13)	10 (7)	8 (6)
3. Heat Energy: Transfer and Conservation	13 (10)	7 (6)	6 (4)
4. Electromagnetic Systems	17 (13)	9 (7)	8 (6)
5. Chemical Properties and Changes	17 (13)	10 (8)	7 (5)
6. Environmental Quality	17 (13)	8 (6)	9 (7)
Total	100 (75)	56 (43)	44 (32)

\*The number of questions on the test may vary slightly from those indicated in the learning domain.

The relative emphasis of question contexts for each program area is indicated in the following table.

### Program Area Emphasis by Topic

Topic	Program Area		
	Nature of Science	Science and Technology	Science, Technology, and Society
1. Diversity of Living Things	A	C	B
2. Fluids and Pressure	A	A	C
3. Heat Energy: Transfer and Conservation	A	A	C
4. Electromagnetic Systems	B	A	C
5. Chemical Properties and Changes	A	B	C
6. Environmental Quality	A	B	A

A—High Emphasis

B—Moderate Emphasis

C—Low Emphasis

## Confirming Standards

Confirming standards is a process whereby judgements about students' performance on the assessment are made in relation to provincial standards. For more information on confirming standards procedures, refer to Appendix A of the *Achievement Testing Program Provincial Report, June 1993 Administration*. For information on the selection of teachers for participation in the confirming standards process, refer to the *Achievement Testing Program General Information Bulletin*.

## Preparing Students for the Assessment

We hope that teachers share the following information with their students and help them prepare for writing the Grade 9 Science Achievement Assessment.

*I strongly advocate preparing children to understand tests and testing through extensive class discussion about the makeup of the test and how to take it, and then adequate practice to find out their own particular weaknesses in approaching tests.*

—Graves, p. 183

- Talk with your students about some of the positive and negative aspects of taking tests. Share some of your own experiences and have your students share theirs.
- Familiarize your students with the format of the achievement assessment and the kinds of questions that will appear on it by having them work through the sample questions.

## Suggestions for Answering Machine-Scorable Questions

- The questions in the achievement assessment are integrated in narrative themes.

A theme page has a picture and a short description of what the questions that follow are about. Students should study the theme page carefully—there may be information that can be used to answer the questions.
- Students should use other information given for answering questions by:
  - a. reading the information and thinking carefully about it before trying to answer any of the questions that need the information; or
  - b. reading the questions first and then reading the information, keeping in mind the questions they need to answer.
- When information is given for more than one question, students should go back to the information before answering each question.
- Students must make sure they look at all forms of information given. Information may be given in words, charts, pictures, graphs, and maps.
- Students should choose the answer they think is best. If they don't see a correct or best answer right away, they are encouraged to find the two choices that seem closest to the correct answer and pick one of them for the answer.



### ***Suggestions for Answering Numerical-Response Questions***

- Make sure you look at all the information given.
- Calculate your answer and check your work before entering the answer on the answer sheet.

### ***Sample Questions***

The following sample questions reflect the nature and complexity of the questions that will appear on the Grade 9 Science Assessment.

We encourage teachers to familiarize students with the assessment by having them work through these sample questions. A practice answer sheet for the numerical-response questions is provided on page 18 so that students can familiarize themselves with this new form. Please note that this collection of sample questions does not represent the assessment emphasis as presented in the blueprint.

Questions 1 to 13 are multiple-choice questions. Questions 14 and 15 are numerical-response questions.

*Use the following information to answer question 1.*

Tom observed some fish at an aquarium. One looked like this.

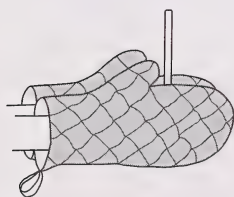


1. In its natural habitat, this fish lives
  - A. at the bottom of a shallow lake
  - B. near the surface of a shallow lake
  - C. just above the weeds along the shore of a deep lake
  - D. midway between the surface and bottom of a deep lake
2. A biologist was photographing a *Felis leo* in Africa. The Linnaean classification categories that are used for this organism's scientific name are
  - A. Order Class
  - B. Class Genus
  - C. Order Species
  - D. Genus Species

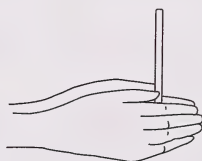
Use the following information to answer question 3.

The oil in the heavy oil fields near Cold Lake is often too thick to pump from underground. Workers inject superheated steam into the formations so the oil can be pumped out.

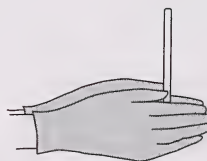
3. This procedure works because the viscosity of liquids
- A. decreases with an increase in water content
  - B. increases with an increase in water content
  - C. increases with an increase in temperature
  - D. decreases with an increase in temperature
4. Sandy observed smoke rising from a birthday candle. Air around a candle flame rises because
- A. air particles lose energy
  - B. air particles become lighter
  - C. air becomes a vacuum next to the flame
  - D. air becomes less dense than the surrounding air
5. A lab technician is finding the quickest method to heat milk samples. There are four tubes, each with 20 mL of milk and at a temperature of 20°C. The technician holds each tube for five minutes. The rise in temperature would be quickest in the tube shown in



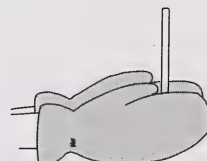
oven mitts  
**A.**



bare hands  
**B.**



cotton gloves  
**C.**

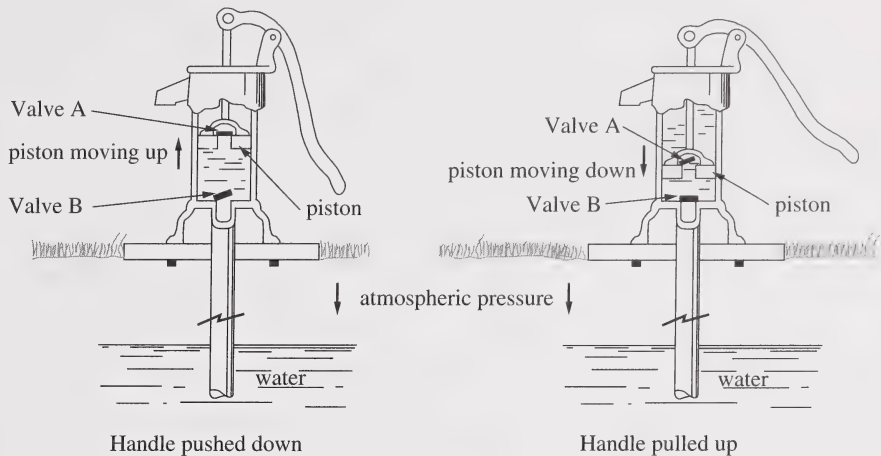


down-filled mitts  
**D.**



Use the following information to answer question 6.

A farmer uses a lift pump to water horses. The diagram shows how a lift pump operates.

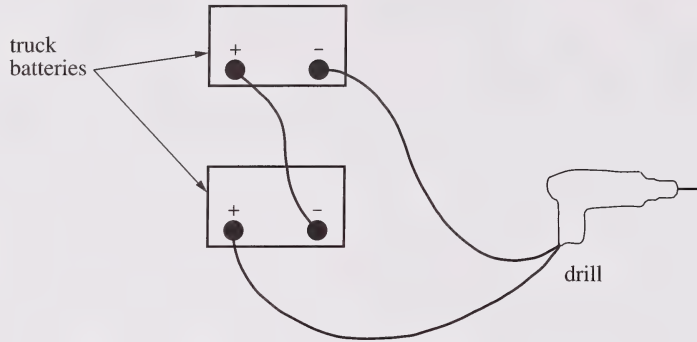


6. The function of valve A is to

- A. remain closed when the piston is pulled up, thereby lowering pressure so that the water rises
- B. remain open when the piston is pulled up, thereby lowering pressure so that the water rises
- C. remain closed when the piston is pushed down, thereby preventing water from moving down into the well
- D. remain open when the piston is pushed down, thereby allowing water to move down into the well

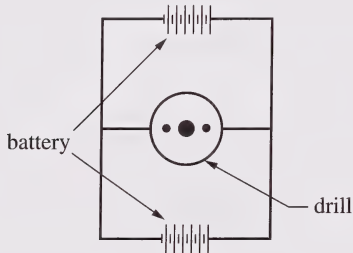
Use the following information to answer question 7.

A mechanic has a power drill that operates on a 24-volt power supply. The mechanic and her helper have two trucks, each of which operates from a 12-volt wet cell battery. In order to operate the power drill, the mechanic hooked it up to the truck batteries, as shown:

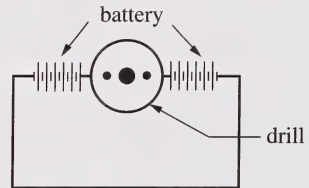


7. The schematic diagram that shows the circuit that will work best is

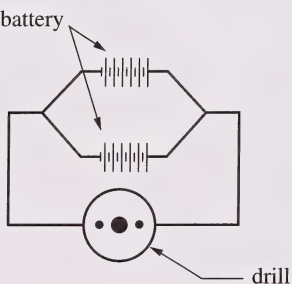
A.



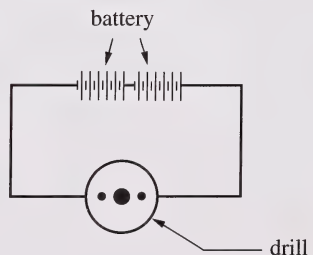
B.



C.



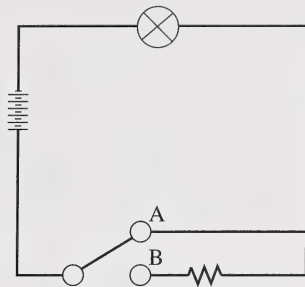
D.





Use the following information to answer question 8.

Tom is checking the circuit diagram for the interior light in his car.



**Legend**



Lamp



Battery



Switch



Resistor

8. If the switch is moved from contact point A to contact point B, the bulb will

- A. dim
- B. brighten
- C. burn out
- D. not change

Use the following information to answer question 9.

The table shows observations made when a few drops of various liquids were added to four powders.

Powder	Liquid Added		
	Water	Iodine	Vinegar
Baking Soda	liquid sinks into powder	liquid stays reddish-brown and sinks into powder	liquid fizzes
Baking Powder	liquid fizzes	liquid turns from reddish-brown to blue-black and fizzes	liquid fizzes
Cornstarch	liquid sinks into powder	liquid turns blue-black and sinks into powder	liquid sinks into powder
Talc	liquid beads on top of powder	liquid turns orange and beads on top of the powder	liquid beads on top of powder

9. A baker found an unlabelled can of white powder. When he adds vinegar to the unknown powder, the powder fizzes. Based on the information in the table, which conclusion about the unknown powder is valid?
- A. The powder is baking soda, and no more information is needed.
  - B. The powder could be cornstarch, but more information is needed.
  - C. The powder could be baking soda, but more information is needed.
  - D. The powder is baking powder, and no more information is needed.



Use the following information to answer question 10.

Indicators	Acid	Base	Neutral
Red Litmus	Red	Blue	Red
Blue Litmus	Red	Blue	Blue
Phenolphthalein	Colourless	Pink	Colourless
Congo Red	Red	Blue	Blue

10. A scientist tested an unknown household cleaner. Colourless phenolphthalein did not change colour when added to a sample of the cleaner. The scientist could infer that the unknown household cleaner was
- A. a base
  - B. an acid
  - C. a base or neutral
  - D. an acid or neutral

Use the following information to answer questions 11 and 12.

Ms. Beetle's Grade 9 class was concerned about the quality of water in Poplar River. They carried out a water quality study by sampling freshwater invertebrates from five different locations along the Poplar River. The results are shown below.

Name	Number of Freshwater Invertebrates				
	Upstream of STP	1 km downstream of STP	20 km downstream of STP	50 km downstream of STP	100 km downstream of STP
Mayfly Larvae	256	2	26	163	228
Beetles	26	13	16	18	23
Caddisfly Larvae	48	2	8	30	46
Worms	14	164	120	56	18
Leeches	19	98	54	30	20

\*STP = Sewage Treatment Plant

11. From these data, the **best** inference is that

- A. all invertebrates are affected by the Sewage Treatment Plant
- B. fishing would be better upstream from the Sewage Treatment Plant
- C. only worms and leeches are unaffected by the Sewage Treatment Plant
- D. the entire invertebrate population is unaffected by the Sewage Treatment Plant

12. At what point downstream from the Sewage Treatment Plant will the invertebrate population be **about the same** as the upstream population?

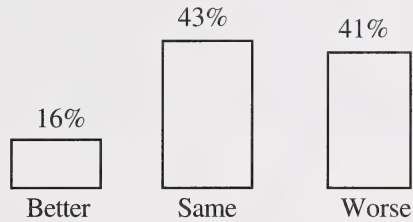
- A. 1 km
- B. 20 km
- C. 50 km
- D. 100 km

Use the following information to answer question 13.

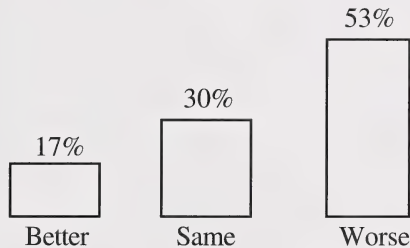
### ENVIRONMENTAL QUALITY POLL

A group of students conducted an environmental survey because a number of industrial plants are being built in their community. Two of the questions and the percentage of answers are shown below.

1. Is the quality of the environment you live in better, worse, or about the same as it was five years ago?



2. What you think the quality of the environment you live in will be like five years from now?



13. These results reveal that most people feel that the environment

- A. will be worse five years from now
- B. will be better five years from now
- C. has become better in the past five years
- D. has become worse in the past five years





2. On the line provided, place the number that matches the diagram of a specific stage of the butterfly metamorphosis.

1



2



3



4



\_\_\_\_\_

egg                  larva                  pupa                  adult

Answer: 2 1 4 3

2	1	4	3
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9	9	9	9



## Practice Answer Sheet for Numerical-Response Questions

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9	9	9	9

11

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0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
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6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

12

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3	3	3	3
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8	8	8	8
9	9	9	9

13

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3	3	3	3
4	4	4	4
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8	8	8	8
9	9	9	9

14

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9	9	9	9

15

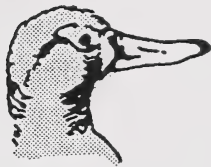
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0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

14. A zoo worker stored bird feed according to feeding habits. Place the number of the bird on the line above the feeding habit that its beak is best adapted for.

1 Duck



2 Cockatoo



3 Hawk



4 Heron



Answer:

                      
Cracking seeds

                      
Catching fish

                      
Straining Food

                      
Tearing flesh

RECORD YOUR ANSWER IN THE NUMERICAL-RESPONSE  
SECTION OF THE ANSWER SHEET



15. A builder was researching the performance of different materials used to insulate homes. The RSI (insulation) value of four building materials is shown in the table below.

Material Number	Material Name	RSI per Centimetre
1	polystyrene	0.35
2	wood	0.10
3	fibreglass	0.24
4	brick	0.014

Record the order, by material number, of the **best** insulator to the **worst** insulator of these four materials.

Answer: \_\_\_\_\_

RECORD YOUR ANSWER IN THE NUMERICAL-RESPONSE  
SECTION OF THE ANSWER SHEET

## Key and Descriptors for Sample Questions

Ques.	Key	Topic	Learning Domain	Curriculum Standard	Assessment Standard*
1	A	Diversity of Living Things	Skill	infer environmental conditions for observations of a fish	A
2	D	Diversity of Living Things	Concept	know the Linnaean classification system	A
3	D	Fluids and Pressure	Skill	predict the effects of temperature changes on fluid viscosity	A
4	D	Heat Energy	Concept	identify and interpret applications of heat convection	A
5	B	Heat Energy	Skill	predict the effectiveness of insulating material for gloves	A
6	A	Fluids and Pressure	Concept	understand the operation of a lift pump	A
7	D	Electromagnetic Systems	Skill	interpret an electric circuit and select its circuit diagram	E
8	A	Electromagnetic Systems	Skill	predict the effect of a resistor in a circuit	A
9	C	Chemical Prop. and Changes	Skill	interpret a table of test results to identify an unknown powder	E
10	D	Chemical Prop. and Changes	Skill	interpret a table of acidity tests to infer the acidity of a liquid cleaner	A
11	A	Environmental Quality	Skill	infer the quality of an environment from a table of invertebrate populations	E
12	D	Environmental Quality	Skill	predict the population of invertebrates at a river location	E
13	A	Environmental Quality	Skill	interpret graphs about people's attitudes about the environment	A
14	2, 4, 1, 3	Diversity of Living Things	Skill	infer the feeding habits of birds from the shape of their beaks	A
15	1, 3, 2, 4	Heat Energy	Skill	order materials according to their insulating values	A

\*A—Students meeting the acceptable standard should be able to correctly answer questions such as these.

E—In addition to answering the questions identified for the acceptable standard, students meeting the standard of excellence should be able to correctly answer questions such as these.

## ***Credit***

Donald H. Graves, *Build a Literate Classroom* (Toronto: Irwin Publishing, 1991), p. 183

## ***Alberta Education Contact***

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